ASSESSMENT OF DEPOSITIONAL VARIABILITY, CONTAMINATION AND ECOLOGICAL RISKS OF HEAVY METALS IN SEDIMENT CORES FROM LAGOS LAGOON, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF CHEMISTRY, COLLEGE OF SCIENCE AND TECHNOLOGY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN INDUSTRIAL CHEMISTRY, COVENANT UNIVERSITY, OTA, NIGERIA.

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CERTIFICATION

This is to certify that this project was carried out by EKETT, Simeon Israel (16PCC01350) under the supervision of Professor N. U. Benson. This report has been read, approved and accepted as meeting the partial fulfilment of the requirements for the award of the degree of Master of Science in Industrial Chemistry of Covenant University, Ota, Nigeria.

Professor Nsikak U. Benson ……
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Professor Wesley O. Okiei ……
External Examiner Signature/Date

Professor Samuel T. Wara ……
Dean, School of Postgraduate Studies Signature/Date

DEDICATION

To God Almighty, my sufficiency and my all in all. Also dedicated to my wife, Pheobie Simeon and children, Awaji-mijan and Awaji-moroiso.

DECLARATION

I, EKETT Simeon Israel, hereby declare that this project report is based on the study undertaken by me in the Department of Chemistry, College of Science and Technology, Covenant University, under the supervision of Professor N.U. Benson. This project report has not been submitted anywhere else for a degree award. The ideas and reviews are products of the research conducted by me. All sources of data and scholarly information of other researchers have been duly acknowledged.

EKETT, Simeon Israel ……

Signature & Date

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LIST OF ABBREVIATIONS

CCV	-	Continuous Calibration Verification Standard
ERL	-	Effects Range Threshold
ERM	-	Effects Range Median
GPS	-	Global Positioning System
$HClO_4$	-	Perchloric Acid
HNO_3	-	Nitric Acid
H_2SO_4	-	Sulphuric Acid
ICB	-	Initial Calibration Blank
ICV	-	Independent Calibration Verification
MET	-	Minimal Effect Threshold
MP-AES	-	Microwave Plasma Atomic Emission Spectroscopy
PAHs	-	Polycyclic Aromatic Hydrocarbons
PCBs	-	Polychlorinated Biphenyls
PES	-	Plasma Enable Switch
PEL	-	Probable Effect Threshold
QA/QC	-	Quality Assurance/Quality Control
SEL	-	Severe Effect Level
SQGs	-	Sediment Quality Guidelines
SRM	-	Standard Reference Material
TEL	-	Threshold Effect Level
WHO	-	World Health Organization

ABSTRACT

Heavy metal contamination poses significant risks to ecosystem and biota health; however, no information is available on the depth distributions and ecological risks associated with metal pollution in sediment cores from microtidal Lagos lagoon. One hundred (100) sediment samples from four (4) sediment cores were collected from georeferenced locations in Lagos lagoon using a 50 cm × 3.5 cm Wildco® hand corer. The determinations of major elements (Al, Ca, Fe, K, Mg, and Na) and potentially toxic metals (Ba, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sr, V, and Zn) were carried out using Microwave Plasma Atomic Emission Spectrometry (4200 MP-AES) after extraction. Mean concentrations of elements ranged between 200.69±78.80 – 283.71±88.90 mg/kg, 0.06±0.02 – 0.09±0.14 mg/kg, 43.23±14.63 – 62.89±22.19 mg/kg, 0.83±0.37 – 0.99±0.26 mg/kg, 0.16±0.08 – 0.31±0.10 mg/kg, 0.33±0.14 – 0.40±0.09 mg/kg, 0.34±0.08 – 0.65±0.29 mg/kg, 213.52±78.63 – 259.90±58.27 mg/kg, 21.52±6.70 – 25.91±5.06 mg/kg, 45.13±12.28 – 48.64±9.45 mg/kg, 2.93±0.54 – 3.17±0.55 mg/kg, 54.37±19.32 – 95.39±37.65 mg/kg, 0.07±0.04 – 0.08±0.02 mg/kg, 0.99±0.39 – 1.53±0.45 mg/kg, 0.50±0.11 – 0.67±0.33 mg/kg, 0.32±0.18 – 0.48±0.16 mg/kg, and 1.41±0.35 – 2.97±0.80 mg/kg for Al, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sr, V, and Zn, respectively. Heavy metal pollution assessment of sampled sediments was carried out using different quantitative contamination indexes of the respective elements and consensus-based sediment quality guidelines (SQGs). The mean concentrations of some metals in sediment cores were remarkably higher than the SQGs thereby raising potential ecological risks to the sediment-dwelling biota, humans and the lagoonal ecosystem. The surface to down-core depositional distributions of the investigated elements indicated varied degree of contamination influenced largely by contributions from land-based anthropogenic activities. The results of elemental concentrations in this study should be considered as baseline data for heavy metals monitoring of sediment in the area.